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BABESIASIS (PIROPLASMOSIS).

(58) WENYON (C. M.). **Piroplasmosis of Rhodesian Sheep, as observed, by Bevan.**—*Jl. Comp. Path. & Therapeutics.* 1915. Mar. Vol. 28. No. 1. pp. 60–61.

BEVAN has forwarded to the Wellcome Bureau of Scientific Research a number of blood films from a Rhodesian sheep which was suffering from both anaplasmosis and piroplasmosis.

That the parasites present were piroplasms and not organisms of the Theileria type was shown by the fact that no bodies resembling Koch's bodies were found in any of the internal organs. The parasites were, however, very variable in shape and some of them were very small. As none but local sheep were available for inoculation it is possible that the experimental inoculations carried out may not succeed, owing to the animals used having acquired some degree of immunity.

TRYPANOSOMIASIS.

(59) LANFRANCHI (A.). **L'Oftalmo e l'Intrapalpebro-reazione nella Diagnosi e nella Differenziazione di Alcune Tripanosomiasi. Nota Preventiva.** [The Ophthalmic and Intrapalpebral Reactions in the Diagnosis and Differential Diagnosis of the Trypanosomiases. Preliminary Note.]—*Il Moderno Zooiatro.* Parte Scientifica. 1915. Jan. 31. Vol. 36. No. 1. pp. 1–3. With 2 text-figs. and *Bull. Soc. Path. Exot.* 1915. Mar. Vol. 8. No. 3. pp. 112–115.

In this paper the author briefly records some observations regarding the diagnosis of trypanosomiasis by means of the ophthalmic and the intrapalpebral tests, using extracts of trypanosomes derived from rats. The trypanosomes used in the experiments were the trypanosome of surra and *T. brucei*. The extracts were made with glycerin, alcohol, ether, chloroform, and distilled water, following LEVADITI's technique.

The conclusions are as follows :—

It was possible with a glycerin or an alcoholic extract of the infecting trypanosome not only to arrive at a diagnosis of surra in the dog, but to distinguish the infection from nagana.

In the horse it was possible to obtain similar results with these extracts, both by the ophthalmic and the intrapalpebral methods.

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The author intends to examine the question as to whether during afebrile periods a diagnostic elevation of temperature can be obtained by the intrapalpebral test.

(60) Webb (E. Clive). **Trypanosomiasis of Donkeys and Mules in the Anglo-Egyptian Sudan.**—*Jl. Comp. Path. & Therapeutics.* 1915. Mar. Vol. 28. No. 1. pp. 1–20.

The common trypanosome of the mule and the donkey in the Sudan is a polymorphic one, and the author thinks that it is identical with the polymorphic *T. brucei*. Brief details are given of a number of experimental inoculations carried out both with mule and donkey trypanosomes upon a variety of species of animals.

The paper also includes an account of the treatment with atoxyl and arsenic adopted in the case of a number of diseased mules and donkeys. The general lines followed were those laid down by Holmes for the treatment of surra.

The total number of animals submitted to treatment was 22. Of these 12 died and 10 recovered.

The results obtained are not so favourable as those obtained by Holmes, but provided the cures are permanent they are not unsatisfactory. It is pointed out that the great majority of animals were in very poor condition when the treatment was started and some of them were actually in extremis.

In treating the animals the dosage was severe, the treatment being pushed to a dangerous extent; one of the reasons for this being that any treatment which is to be economically practicable must be of short duration. Owing to a shortage of atoxyl, treatment with arsenic was adopted as far as possible, and in five instances death was actually due to or hastened by arsenical poisoning.

(61) Aubert (P.) & Micheli (M.). **Essais de traitement des infections expérimentales à *Trypanosoma gambiense* et *dimorphon* avec des "Suspensions huileuses d'Arsenic et d'Antimoine" (Métoléine). Note préliminaire.** [Experiments regarding the Treatment of Animals infected with *T. gambiense* and *T. dimorphon* by Means of Arsenic and Antimony suspended in Oil (Metoleine). Preliminary Note.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 28–30.

The name Metoleine has been given by Deguy and Lesure to suspensions in oil of finely divided metals or metalloids. The arsenic metoleine contains 8 per cent. of arsenic and the antimony metoleine 20 per cent. of antimony. The oily excipient contains 11·75 per cent. of anhydrous lanoline and 88·25 per cent. of vaseline oil.

The authors have carried out a small number of experiments with guinea-pigs experimentally infected with *T. gambiense* and *T. dimorphon*.

The drugs were administered in doses ranging from $^1/_{10}$ – $^3/_{10}$ cc. by intramuscular injection, and no evidence of reaction was observed at the seat of injection. Both the suspensions appeared to exercise a distinct trypanocidal effect.

The metals are absorbed very slowly and also very slowly eliminated.

(62) LAVERAN (A.). **Le dérivé O_1 du Diaminoarsénobenzène dans les trypanosomiases du chien et du cobaye.** [The O_1 Derivative of Diaminoarsenobenzene in the Treatment of Trypanosomiasis of the Dog and the Guinea-pig.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 31–32.

Five dogs infected with *T. gambiense*, *T. congolense*, and *T. soudanense* were treated by intravenous injections of O_1 in doses of 2 to 3 cg. per kilogramme. Of the three dogs infected with *T. congolense* two appeared to have made a complete recovery after 6 or 8 injections. In the two dogs inoculated with *T. gambiense* and *T. soudanense* only a temporary improvement was noted, a fatal termination occurring in both cases.

Possibly the results were not as good as they might have been owing to the fact that only 2 cg. per kilogramme were given at first, whereas 3 cg. is borne quite well by the dog.

Experiments with guinea-pigs failed owing to the production of very severe lesions at the seat of injection when the drug was administered intramuscularly.

In one instance, however, a remarkable result was obtained. A guinea-pig inoculated with an atoxyl-resistant strain of *T. gambiense* was given an injection (method not stated) of 5 cg. of O_1. The trypanosomes disappeared from the circulation in 24 hours. Four further injections of 4 to 5 cg. were given and trypanosomes did not reappear in the blood until the 57th day after the first injection. The guinea-pig died five days later after giving birth to five dead young.

(63) MESNIL (F.) & MOTAIS (F.). **Sur l'action trypanocide *in vivo* d'un dérivé (OK_1) du diaminoarsénobenzène.** [The Trypanocidal Action *in vivo* of OK_1 a Derivative of Arsenobenzene.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 32–34.

In this short paper the author publishes the incomplete results of some experiments which were interrupted in August 1914.

OK_1 is a yellowish powder which is very stable when exposed to the air, is easily soluble in water, and when in solution does not rapidly undergo any alteration. Subtoxic doses when injected subcutaneously are well borne.

By experiment it was found that the toxic dose for a mouse weighing 20 grammes was 0·60 cg. The therapeutic dose for a mouse of this size was therefore fixed at 0·3 cg. Three mice infected with nagana and six with *T. gambiense* were subjected to treatment, and recovery occurred in every instance. Exactly similar results were obtained with arsenophenylglycin administered in the same dose.

In every case trypanosomes were numerous in the blood when the treatment was resorted to, and disappeared from the blood within 36 hours. With arsenophenylglycin this disappearance occurred rather more rapidly.

As rats are, in the opinion of the authors, more difficult to cure than mice, two series of experiments were undertaken with this species. The trypanosome used was *T. gambiense*, and the strain used caused a fatal result in mice in 7 days.

The dose used was the same as for mice, i.e., 0·3 cg. per 20 grammes.

In the first series a few of the rats died of intoxication within a few days of the administration of the drug, but those that survived showed no relapse for a period of a month after.

In the second series some of the rats were treated with arsenophenylglycin, and save in one instance the results were exactly the same.

It is admitted that a month is not a sufficiently long period to allow of a definite opinion as to the permanency of the cure, but it is considered to be sufficiently long to permit the conclusion to be drawn that OK_1 is not inferior to arsenophenylglycin in its trypanocidal action. It is superior to that drug in its stability.

(64) Lafont (A.) & Dupont (V.). **Action comparée, *in vivo*, chez le rat blanc, de l'atoxyl du salvarsan, du néosalvarsan, du galyl et du ludyl sur *T. gambiense* et *Tr. rhodesiense*.** [The Comparative Actions of Atoxyl, Salvarsan, Neosalvarsan, Galyl and Ludyl upon White Rats infected with *T. gambiense* and *T. rhodesiense*.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 37–46.

The conclusions based upon the experiments detailed in this paper may be summarised as follows :—

1. In doses of 0·15 cg. per kilogramme, salvarsan, neosalvarsan, and ludyl do not lead to any diminution in the number of parasites present in the blood, while, on the other hand, a single injection of the same dose of galyl causes a complete disappearance in from 4 to 8 days.

2. While the duration of life in rats infected with *T. gambiense* is on an average 12 days, ludyl and neosalvarsan in the dose mentioned do not cause any change in this period. In rats treated with salvarsan the average period is 18 days, and in those treated with galyl 22 days.

(65) Seidelin (H.). **Experiments with Salvarsan-Copper in Trypanosomiasis.**—*Ann. Trop. Med. & Parasit*, 1915. Mar. Vol. 9. No. 1. pp. 197–200.

The author has carried out a small number of experiments with a salvarsan-copper compound named K_3 obtained from Ehrlich, using rats experimentally infected with a trypanosome of the *T. brucei* group, which had been maintained for some time in rats and guinea-pigs, and proved fatal to the latter species in eight to seventeen days after intraperitoneal inoculation.

It was found that a dose of 0·0064 g. failed to effect a permanent cure in rats weighing 60 grammes, and with this dose areas of necrosis at the seat of inoculation were produced in some cases and in others death resulted.

(66) Duke (H. L.). **The Wild Game and Human Trypanosomiasis; with some Remarks on the Nomenclature of Certain Pan-African Trypanosomes.**—*Jl. Trop. Med. & Hyg.* 1915. Jan. 15. Vol. 18. No. 2. pp. 13–16.

In this paper reference is first made to the trypanosomes occurring in man. The features of these parasites to which attention is drawn are the following: *T. gambiense* is insusceptible to the action of human serum, it causes a chronic disease in cattle, sheep and goats,

and runs a relatively chronic course in dogs and small laboratory animals. *T. rhodesiense* on the other hand is susceptible to the action of human serum, and produces a more acute infection both in man and in animals. Neither of the trypanosomes causes disease in wild animals.

Proof has been furnished of the part played by game as a reservoir for *T. gambiense* by the fact that two fly boys employed by CARPENTER have contracted the infection after a residence of 18 and 33 months on the lake shore, and this at an interval of five years after the removal of the inhabitants.

The facts with regard to the other trypanosome causing disease in man—*T. rhodesiense*—are different. There has never been anything like the loss of life caused by this organism that there has been by *T. gambiense*, and eminent English observers are of the opinion that the evidence indicates that *T. rhodesiense* and the polymorphic trypanosomes showing posterior nuclear forms occurring in game are identical.

In addition to these polymorphic trypanosomes there are two easily recognised types which have a very wide distribution. These are the *T. vivax*, and the *T. congolense-nanum* (*pecorum*) groups.

During their development in Glossina these three groups behave in different ways. In the vivax group only the proboscis of the fly is invaded; in the congolense group the gut and the proboscis are involved; and in the polymorphic group development takes place in the gut and the salivary glands.

The majority of mammalian trypanosomes occurring in Africa can be placed in one or other of these groups, and in the author's view difficulties arise when attempts are made to get further subdivisions, owing to the unnatural way in which the finer tests are carried out. Emphasis is laid upon the part played by the transmitting flies, and upon the inadvisability of founding any conclusions upon the study of strains that have been maintained exclusively by means of the syringe.

According to Miss ROBERTSON the morphological changes observed in the polymorphic strains indicate definite phases of development of the trypanosomes in the mammalian host. The short form is believed to be especially connected with the infection of the fly, because when the proportion of short forms is high a high percentage of positive flies fed upon such blood is obtained.

Another example of the confusion that has arisen owing to insufficient attention being paid to natural conditions is given in connection with *T. nanum* and *T. congolense* (*pecorum*). Originally the strains were distinguishable by their action on the dog and also by the different degree of pathogenicity possessed by them for domesticated ruminants. Upkeep of these strains in the laboratory has gradually eliminated these characteristics.

The suggestion is put forward that all these polymorphic trypanosomes, excluding *T. gambiense*, should be looked upon as one species having its anterior seat of development in the fly in the salivary glands, primarily a parasite of wild game, and too pathogenic for domesticated animals for these to be the principal hosts. *T. gambiense* is mainly distinguished from the other polymorphic strains by its unfailing pathogenicity for man.

With regard to the nomenclature of these parasites the author suggests that they should all be termed *T. brucei*, and he does not consider that *T. rhodesiense* should stand as a good species until it has been proved that the power of infecting man can be maintained through the fly, and that man can be infected from man.

(67) DELANOË (P.). **Au sujet des trypanosomes du type *T. lewisi* Kent rencontrés chez des Muridés dans la region de Bouaké (Côte d'Ivoire).** [The Occurrence of Trypanosomes of the *lewisi* Type in the Muridae encountered in the Bouaké District of the Ivory Coast.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 80–88. With three groups of text-figs.

In 7 out of 53 striped rats belonging to the varieties *Arvicanthis barbarus* and *Arvicanthis barbarus pulchellus* the author has discovered trypanosomes of the *lewisi* type. In five of these animals the parasites were numerous in the blood. Morphologically the trypanosome appears to resemble *T. lewisi* very closely. No lesions were found in the bodies of rats killed when parasites were present in the blood in large numbers.

Adult white rats appear to offer a very high degree of immunity to inoculation with this trypanosome, but it would seem that young white rats can be infected by intraperitoneal inoculation. Two out of three grey rats became infected.

A guinea-pig and some mice failed to become infected, but two young specimens of *Golunda campanae* Huet (a small rodent somewhat resembling the jerboa) became infected and recovered. Owing to the lack of details the author is unable to say whether this trypanosome is identical with that described by WENYON as occurring in the striped mouse in the Soudan.

Trypanosomes of the *lewisi* type were found in 9 out of 66 specimens of *Mus concha* Smith examined. To this parasite the author has given the name *T. eburneense*. As in the case of the previous trypanosomes, the infected animals were caught during both the dry and the rainy seasons. In eight instances the blood was swarming with trypanosomes.

Measurement of 36 parasites appeared to indicate that it is rather longer than *T. lewisi*, and the author believes that the trypanosome is pathogenic, as in two out of four cases rodents of the same species inoculated intraperitoneally died in 25 and 33 days respectively.

Golunda campanae, which has not been found to be naturally infected, is very susceptible to inoculation, while three striped rats failed to become infected. The white rats appear to be refractory, and in the guinea-pig intraperitoneal inoculation leads to a limited multiplication of the parasites in the peritoneal cavity only. *Xerus erythropus* is susceptible, but recovery confers immunity.

A third trypanosome, to which the author gives the name *T. guist'haui*, has been found in savannah rats. Sixteen were found to be infected out of 128 examined. In every instance the parasites were very scantily present in the blood.

The trypanosome ranges from 42 to 47 microns in length.

Young savannah rats, striped rats, *Golunda campanae*, and white rats all resist inoculation.

(68) VIALATTE (C.). **Au sujet d'un trypanosome du chien observé dans le Sahara Oranais.** [A Trypanosome of the Dog discovered in the Oran District of the Sahara.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 70-72.

The animal in which the trypanosome was discovered showed a train of symptoms similar to those generally encountered in cases of trypanosomiasis, and in the later stages there was paralysis of the hind quarters. Examination of the blood on a number of occasions showed that the parasite was sometimes numerously present, sometimes in small numbers, and sometimes quite absent.

The trypanosome ranged from 17 to 24 microns in length and from 1·5 to 2 in width. The free portion of the flagellum measured from 3·5 to 5 microns. The posterior extremity of the body was always more or less obtuse, and granules were frequently present in the anterior half of the body.

Experiments are being carried out with the object of identifying the parasite if possible, but the author appears to incline to the view that the trypanosome closely resembles, at least from the morphological point of view, *T. soudanense* var. *berbera*.

(69) SERGENT (Edm.), LHÉRITIER (A.) & LANDES (L.). **Absence d'immunité héréditaire à l'égard du *Trypanosoma soudanense* chez un chèvreau né d'une chevre immunisée envers ce Trypanosome.** [Absence of Immunity against *T. soudanense* in a Kid born of a Goat immunised against this Trypanosome.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 73–74.

The authors give the details of an experiment the results of which confirm those obtained by LAVERAN regarding the non-transmission of immunity from parent to offspring.

(70) TERRY (B. T.). **The Influence that Serum exerts upon Trypanosomes, with Special Reference to its Use for Experiments in vitro with Atoxyl and Paraminophenylarsenoxyd.**—*Jl. Experim. Med.* 1915. Mar. 1. Vol. 21. No. 3. pp. 250–257.

The bulk of this paper comprises the results of observations made regarding the effects produced upon trypanosomes suspended in salt solutions and sera.

A number of experiments were made in which trypanosomes were suspended in normal salt solution, Ringer's solution made up according to the formulae of MELTZER and of CARREL, and serum derived from different species of animals. In every instance the parasites retained their motility better in the serum than in the other liquids, in which the results were rather variable on different occasions.

Further comparisons were made in which the tubes were kept in an ice chest instead of at room temperature as in the first experiments, and from these it was seen that vitality was retained for a longer time in tubes kept at room temperature than in those kept in the ice chest.

Experiments also showed that not only did the trypanosomes retain their motility and their normal staining reactions better in serum, but also that they retained their pathogenic powers better in the same liquid.

Before the effects of drugs could be tested in vitro it was essential that evidence should be obtained as to whether the serum would produce any alteration in the drugs after the manner of the changes produced by blood. The experiments carried out with this object showed that serum did not exert any actions upon the drugs comparable to those exerted by blood.

The author's conclusions may be summarised as follows :—

Serum preserves the motility of the trypanosome of nagana better than salt solution, and it is preferable to use the serum undiluted. The filtration of the serum through a Berkefeld filter and the storing of it for months in an ice chest does not cause any change in it in this respect.

The vitality of the trypanosomes was preserved better at room temperature than at the temperature of an ice chest, and trypanosomes preserved in serum at room temperature for eight days were capable of infecting experimental animals. Serum does not convert atoxyl into a toxic substance when incubated with it, nor does it bind paraminophenylarsenoxyd.

(71) Brown (Wade H.). **Concerning Changes in the Biological Properties of *Trypanosoma lewisi* produced by Experimental Means, with Especial Reference to Virulence.**—*Jl. Experim. Med.* 1915. Apr. Vol. 21. No. 4, pp. 345–364.

The investigations detailed in this paper were carried out in the course of an inquiry into the possible causes of exalted virulence of *T. lewisi* for the rat, regarding which the author published a paper in 1914 (see this *Bulletin* 1914. Sept. Vol. 2. No. 3, p. 130).

In the instance of exalted virulence recorded in the above paper the indications were that either the method of passage adopted or the character of the rats used, or both of these factors, played some part in the causation of the change.

Four groups of experiments were carried out with the object of ascertaining whether these factors had any determining influence on the point, and two strains of the trypanosome, viz., the so-called pathogenic strain, and a recently isolated strain were used in each case.

In the first series of experiments the animals used were for the most part large, and the inoculations were the ordinary stock transfers. The rate of passage in this series was irregular and slow, and the inoculations were intraperitoneal, two drops of infective blood mixed with 0·5 cc. of salt solution being injected.

In the second series the method of inoculation was the same, but the inoculations were made as nearly as possible at the height of the multiplication of the parasites. Large rats were again used.

In the third series the conditions of the second series were repeated, with the exception that small rats were used in the place of large ones.

In the fourth series, which was a control series, the rats were inoculated in pairs, and at the height of the multiplication of the trypanosomes one of each pair was killed and its blood was used for the inoculation of a fresh pair.

The whole of the results obtained are set out in the form of tables, and the changes produced are grouped under various headings.

In connection with the cycle of infection it was found that when successive inoculations were made at short intervals the tendency was for the period of incubation to become shorter. Special attention is directed to the distinction that must be drawn between true and false incubation, the latter being the appearance of trypanosomes in the blood within a few hours after inoculation when large numbers of trypanosomes are used for infection. It was further found that rapid passage tended to shorten the period between the first appearance of the parasites in the blood and their maximum degree of multiplication. In some instances also it was observed that the duration of the infection tended to become shorter when rapid passage was practised.

The degree of virulence of the trypanosomes in the various groups as judged by the severity of symptoms produced and the number of deaths occurring serially and not in individuals appeared to show that there was a cycle of change. A similar result was obtained with the rats inoculated with blood taken at different stages of infection. This was particularly the case with the pathogenic strain.

The changes in morphology have been described in the previous paper, but it is here pointed out that alterations in morphology were mainly encountered in infections of considerable severity.

In addition to the foregoing experiments a further investigation was started in which the passages were effected when rats appeared to be on the point of recovery. The series could not be completed owing to the failure of the infections after a few generations, but certain results suggested that in such cases the infections might fail owing to the transference of a large quantity of immune bodies and a small number of trypanosomes.

The results obtained are discussed at some length and the following summary is drawn up :—

" 1. Different strains of *Trypanosoma lewisi* represent different states of biological balance, especially between the powers of propagation and resistance to destruction.

" 2. The biological status of a given strain of *Trypanosoma lewisi* is subject to cyclic variations as the result of immunological reactions in the blood of the host.

" 3. The factors limiting reproduction and causing destruction of *Trypanosoma lewisi* in the blood are appreciably independent of each other. It is possible, therefore, to influence these processes separately and even in opposite directions.

" 4. The virulence of *Trypanosoma lewisi*, manifested in its highest form, is dependent upon some degree of reproductive fastness, strong antigenic action, and susceptibility to destruction, varying degrees in the development of these properties producing corresponding variations in the degree of virulence.

" 5. By a properly regulated system of passage the properties of *Trypanosoma lewisi* that determine its infection cycle and its virulence may be eventually so altered as to change completely both the nature and course of the infection. Such a system of passage must be adapted to the particular strain of *Trypanosoma lewisi* used.

" 6. Immunological reactions exercise a dominant influence in determining the ultimate biological variations of *Trypanosoma lewisi*."

(72) Carini (A.) & Maciel (J.). **Sur un hémogregarine et un trypanosome d'un muridé** (*Akodon fuliginosus*). [A Haemogregarine and a Trypanosome of *Akodon fuliginosus*.]—*Bull. Soc. Path. Exot* 1915. Apr. 15. Vol. 8. No. 4. pp. 165–169. With 2 text-figs.

(*Leuco-*) *Haemogregarina akodoni*.—The rats in which this parasite

was found showed no evidence of ill health even when considerable numbers of them were present in the blood. The parasites were oval in shape measuring 10 by 3·5 microns. The majority of the organisms seen were within large mononuclear leucocytes applied closely to the side of the nucleus. They possessed a hyalin cytoplasm and an oval granular nucleus. All the parasites appeared to be at the same stage of development and in none of them could a micronucleus be detected. Free forms in fresh preparations appeared to execute slow vermicular movements.

Trypanosoma akodoni.—In addition to the haemogregarines trypanosomes were also found in the blood of some of the rats examined. They were not numerous, but they could be found in every preparation made.

In the living state they were very actively motile. In stained preparations it was seen that the blepharoplast, which was situated close to the posterior extremity, was large and oval in shape, and was placed transversely in the body. The nucleus was placed about the middle point of the body, and the undulating membrane was well developed and showed two or three folds. The parasite appeared to resemble *T. cruzi*. It apparently failed to infect guinea-pigs and kittens which were inoculated by the authors.

Some laboratory bred larvae of *Triatoma infestans* were fed with blood containing the trypanosome, but no flagellates could be found in their intestinal contents.

(73) Ouzilleau (F.). **Rapport d'ensemble sur la maladie du sommeil dans le Bas-M'Bomou (1912-1913).** [Report on Sleeping Sickness in Lower M'Bomou.]—*Bull. Soc. Path. Exot.* 1915. Mar. Vol. 8. No. 3. pp. 138–154 & Apr. Vol. 8. No. 4. pp. 178–198.

This report contains a few lines regarding the trypanosomes encountered in animals in the district (pp. 197–198).

There are only two herds of cattle in the district, each of which numbers about 30 animals, and there are very few horses and donkeys. All the animals come from the Anglo-Egyptian Soudan.

No cases of trypanosomiasis in the horse have been encountered by the author. *Trypanosoma pecaudi* has been seen in cattle, and on one occasion an outbreak caused by this parasite resulted in the death of ten out of thirty animals. A number of the cattle harboured the parasite without showing any clinical symptoms.

The same trypanosome was discovered at Bangassou in some donkeys which had been imported from Bahr-el-Ghazal.

(74) Minchin (E. A.) & Thomson (J. D.). **The Rat Trypanosome, *Trypanosoma lewisi*, in its Relation to the Rat Flea, *Ceratophyllus fasciatus*.**—*Quart. Jl. Microscop. Sci.* 1915. Jan. Vol. 60. No. 4. pp. 463–602. With 20 plates and 24 text-figs.

This monograph is divided into the following three parts :—

I. Notes on the flea, anatomy, methods of dissection, parasites of the flea, histological structure of the stomach, and technique.

II. Development of *T. lewisi* in the flea, (*a*) the stomach phase, (*b*) migration to the rectum, (*c*) rectal phase.

III. Experimental study of the problems of transmission and development.

In the first section full details of the methods adopted for the dissection of the fleas and of the anatomical structure of the organs are given.

Special attention is drawn to the fact that the authors' fleas were free during the whole of their experiments from flagellate parasites other than that with which they were working, and a summary of the evidence establishing this point is given.

The authors deal at considerable length with the technique adopted in the preparation of permanent specimens, both smears and sections.

In the second portion of the paper the development of *T. lewisi* in the rat flea is dealt with, and the following is a condensed account of the cycle.

Fleas which have been fed upon infected rats are not again infective for susceptible rats until a period of six days has elapsed, as the stumpy form of trypanosome which represents the final stage of development in the flea does not make its appearance in the rectum until the fifth day after the infecting meal.

Except for the occurrence of small crithidial forms in the Malpighian tubes the entire cycle of development is carried through in the alimentary canal. There is no invasion of the salivary glands.

The cycle of development can be divided into two more or less sharply defined phases, viz., a stomach and rectal phase.

The stomach phase is generally short, amounting only to 24–48 hours, but occasionally longer. During this phase the trypanosomes penetrate the epithelial cells of the stomach lining and undergo a process of multiple division.

In the intestine the trypanosomes do not come to rest, but merely pass through on their way to the rectum.

The rectal phase consists of small individuals which are crithidial in structure, and are attached by the end of the flagellum to the wall of the gut. In this position repeated binary fission occurs. This phase appears to continue as long as the flea remains alive. By modification the crithidial forms give rise to trypanosome forms by which the infection of the rat is brought about.

It is only about 25 per cent. of fleas that show these phases of development of the trypanosomes, in the remainder the trypanosomes ingested appear to die out, and consequently it is necessary to recognise those forms which represent degenerative changes. A great deal of information upon this point was gained by the authors through the examination of fleas at given intervals after feeding.

In the phases of normal development of the trypanosomes in the stomach the following stages in the process of multiplication can be established from the examination of smears and sections and of living preparations :—

1. Trypanosomes of ordinary appearance which seem to have recently penetrated into the epithelial cells.

2. Flat-end pear-shaped forms which are produced by a doubling of the body upon itself.

3. Rounded or oval forms which are produced from the pear-shaped forms by a further rolling or doubling up of the body. There are

apparently no leishmania-like forms without any flagellum. In these rounded forms process of multiplication can be seen. The division of the various structures goes on much as in ordinary trypanosomes. The flagellum does not split, but the daughter parasites are provided with new flagella which grow out from the daughter kineto-nuclei.

4. The final stage of intracellular multiplication is represented by the " sphere " stage. In this stage the parasites form large rounded masses in the epithelial cells. The invasion of any cell may be single or multiple, and the parasites are in a state of constant movement within the host cell. Some of these spheres show a " tail " composed of flagella and others are " tailless." In the latter the flagella are wrapped round the body. Finally the mass separates into a number of individuals which are set free by the rupture of the cell containing them. The number of individuals produced varies, but in many instances eight were observed.

The parasites produced in this way are crithidiomorphic, the nuclei being more or less closely placed to each other, and they are very long.

It cannot be stated how long this process of multiplication requires for its completion, nor can it be stated how many times it may be repeated.

The crithidiomorphic parasites pass straight through the intestine, and by the time that they reach the rectum the posterior extremity has generally become club-shaped.

In the rectal phase the parasite loses its very marked activity and becomes sluggish. It also shows a great tendency to adhere to debris, cells, and even to the cover-glass by means of its flagellum. The body becomes shortened and changes its shape owing to a concentration of the cytoplasm towards the posterior extremity of the body. The flagellum also becomes shortened. The kineto-nucleus takes up a position beside or in front of the tropho-nucleus, and then the parasites multiply by division. The order given does not of necessity indicate their chronological succession, but it is established that no multiple division occurs in the rectum, and also that there is no intracellular stage.

In the fully established rectal phase the parasites are all small crithidial forms, many of which are attached to the epithelial cells by their flagella. This phase is rarely established less than 36 hours after the infective feed. Multiplication of these forms in the rectum probably continues as long as the flea lives, but a proportion of the parasites become developed into stumpy trypaniform individuals which represent the final propagative phase, and at this stage the development in the rat comes to a stop.

Degenerative changes. Degenerating trypanosomes are most abundantly present in fleas examined during the first 24 hours after feeding, and they have generally quite disappeared within 36 hours, but they may sometimes be found later. The parasites either begin to degenerate immediately after they are taken up by the flea, or they may develop to a certain extent and then undergo degenerative changes. It is organisms that have proceeded to a certain stage of development before undergoing degeneration that account for the late degenerative changes observed.

The principal feature which marks degeneration is a progressive diminution in size, the shrinkage commencing at the flagellar end and

extending backwards. Degenerating forms show a great tendency to form clumps, but these clumps are distinguishable from the true agglomerations in that the parasites attach themselves to each other by the flagellar ends. In the final stage the parasites are very small, and they simply represent the hinder ends of the original trypanosomes. Among the degenerative forms in the rectum recurved forms similar to those normally occurring in the stomach are sometimes found.

The authors have never been able to find any evidence that there is a sexual stage in the development of *T. lewisi*.

In Part III. of the paper are discussed the experimental studies of the problems of transmission and development.

After dealing with the technique employed in the care and handling of the rats and fleas, the authors proceed to a discussion of the general problems.

It is held by the authors that the following facts have been established by experiment :—

Trypanosoma lewisi is transmitted from rat to rat by the rat-flea, *Ceratophyllus fasciatus*, and the transmission takes place by the cyclical method only. In a rat infected through the agency of fleas the trypanosomes appear in the blood on the fifth to the seventh day after infection, and multiplication of the parasite in the blood of the rat comes to an end 11 to 13 days after infection. In the flea the parasite requires a period of not less than five days for the completion of its cycle, and fleas are never infective until that cycle is completed. The infection of the rat is brought about through the medium of the small trypanosome-form which is the final stage of development in the flea and which takes place first in the rectum but may subsequently occur in the stomach also. The whole of the cycle of development goes on in the alimentary tract, and no other part of the flea is invaded by the trypanosome in any stage of its development. Once a flea has become infective it remains so for a long time. The rat becomes infected through ingesting either the moist faeces of infective fleas or the fleas themselves, and the authors' experiments indicate that the flea cannot infect rats through the medium of the proboscis. No evidence was obtained that the trypanosome is passed from flea to flea in an hereditary manner. Only a small proportion of the fleas which have access to infection become infective.

The starvation of fleas during the incubative period does not hinder the cycle of development in the flea.

LEISHMANIASIS.

(75) Sergent (Edm.). **Infections expérimentales de la souris par des cultures de la *Leishmania tropica*.** [The Experimental Infection of Mice with Cultures of *Leishmania tropica*.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 22–25.

The author gives details of six experiments in which mice were inoculated either intravenously or intraperitoneally with cultures of *L. tropica* which he had isolated about a year previously from a case of oriental boil at Biskra. The mice were killed four months after inoculation. None showed any skin lesions, but in five of them there

was found to be a generalised infection, and the remaining one was healthy. The parasites were discoverable both by microscopic examination and by cultivation.

The results obtained by other observers are briefly summarised and the conclusion is drawn that up to the present there is so much divergence that no definite opinion regarding the identity of the various strains of Leishmania can be expressed.

(76) Laveran (A.). **Les Leishmanioses chez les Animaux**. [Leishmaniasis in Animals.]—*Ann. Inst. Past.* 1915. Jan. Vol. 29. No. 1. pp. 1–21,* and Feb., No. 2. pp. 71–104. With 2 plates and 2 figs.

iii. Experimental infections produced in different species of animals by *Leishmania donovani*—

It can no longer be held that Mediterranean and Indian kala azar differ from each other in regard to their inoculability into experimental animals, and particularly the dog and the monkey. The fact remains, however, that while the disease occurs as an enzootic among dogs in countries where the Mediterranean disease exists, all efforts to discover centres of canine leishmaniasis in India have, up to the present, failed. It has been found possible to infect dogs and other animals with the Indian disease provided a sufficiently large dose of infective material be given, but the evidence appears to show that the parasite is incapable of developing in *Ctenocephalus felis*, the common dog flea in India.

The paper contains somewhat lengthy summaries of experiments carried out by different observers, including the author, with regard to the infection of dogs, monkeys, flying foxes, mice, and rats, and reference is made to the negative results following the inoculation of guinea-pigs, rabbits, cats, and other animals.

Summarising the results obtained, the author draws attention to the following facts. *L. donovani* and *L. infantum* are both inoculable for the dog, certain species of monkeys, the white mouse, and with less certainty the rat, but the dog is less susceptible to the Indian disease than to the Mediterranean, or to the true canine infection. In addition to the fact that natural infection in the dog has not been observed in India in areas where the disease is endemic in man, is the further fact that it has been found possible to set up lesions in Macacus monkeys with the Indian virus, while attempts to infect the same species with *L. infantum* have so far failed.

A point which suggests the identity of the two diseases, while not furnishing absolute evidence, is that a *Macacus cynomolgus* which had acquired immunity against the Mediterranean disease failed to become infected with the Indian strain, while a control monkey contracted an infection which rapidly proved fatal.

iv. Natural and Experimental infections produced in different species of animals by *L. tropica*—

A summary is given of the recorded cases of cutaneous leishmaniasis in the dog, from which it appears that the condition is not common.

* For abstracts of previous portions of this paper see this *Bulletin.* Vol. 3. No. 1, pp. 19–20.

Some of the facts seem to suggest that one or more species of parasite different from *L. tropica* may be responsible for such lesions.

Experiments are cited to show that the dog, cat, monkeys of various species, mice, rat, guinea-pig, dormouse and merion can be successfully infected with *L. tropica*.

Among the animals in which no successes have been obtained are, the donkey, horse, goat, sheep, rabbit, sparrow, pigeon, and certain lizards.

The general conclusions drawn may be summarised as follows :— The parasite responsible for the disease in dogs cannot be distinguished morphologically from *L. infantum*, and clinically the natural disease of the dog closely resembles the condition set up in that species by inoculation with *L. infantum*. And, while there are still some points that require elucidation, the probabilities appear to be in favour of the view that the two parasites are identical.

With regard to the identity of the Mediterranean and the Indian diseases, it cannot be objected that animals that are susceptible to the one are refractory to the other, but dogs are certainly less susceptible to the Indian than to the Mediterranean infection, and, while it has been found possible to produce cutaneous lesions in monkeys with *L. donovani*, all attempts to produce similar lesions with *L. infantum* have so far failed. The unique experiments in which a cynomolgus monkey which was immune to the Mediterranean disease failed to become infected when inoculated with the Indian virus furnished valuable evidence regarding the identity of the two conditions.

With regard to the production of cutaneous lesions in animals with *L. tropica*, the question is put whether *L. tropica* may not be a variety of *L. donovani* or *L. infantum*, which has become adapted to certain conditions of existence or transmission that are different in some way from those obtaining in the case of these two parasites.

(77) Lafont (A.) & Heckenroth (F.). **Un Cas de Leishmaniose canine à Dakar.** [A Case of Canine Leishmaniasis at Dakar.]— *Bull. Soc. Path. Exot.* 1915. April 14. Vol. 8. No. 4. pp. 162–164.

The case recorded in this paper was observed in a native dog in French West Africa.

The animal was in very poor condition and was affected with mange. Numerous other ectoparasites were also found. At the post-mortem examination the liver was found to be enlarged and pale in colour, and the spleen was also enlarged. There were numerous tubercles in the lungs in which acid-fast bacilli were found. Smears from the spleen and liver showed the presence of numerous Leishmaniae, especially those made from the former. The bulk of the parasites were free, but macrophages and liver cells were both found containing them. In the liver smears there were also found cyst-like forms which appeared to be in a stage of multiplication. These cysts measured from 15 to 20 microns and contained from 2 to 10 parasites. The appearances of those in which only two or three were found suggested that some of the individuals had escaped from the cyst. The parasites are said to have closely resembled *Leishmania infantum*.

(78) DI CRISTINA (G.) & CARONIA (C.). **Sulla Terapia della Leishmaniosi Interna.** [The Treatment of Internal Leishmaniosis.]—*Pathologica.* 1915. Feb. 15. Vol. 7. No. 151. pp. 82–83.

The authors state that they have had satisfactory results from the intravenous injection of antimony tartrate, the drug being used in a 1 per cent. solution and given on alternate days, commencing with a dose of 2 cg. and increasing to 10 cg.

(79) GIUGNI (F.). **Sulla presenza della *Leishmania donovani* e sul suo sviluppo culturale dal sangue periferico nel Kala-azar.** [The Presence of *Leishmania donovani* in the Peripheral Blood and its Cultivation from it.]—*Malaria e Malat. d. Paesi Caldi.* 1915. Feb. 20. Vol. 6. No. 1. pp. 16–20.

The author records three cases in which the parasites could be detected by microscopic examination of the blood, but all attempts to obtain cultures from the peripheral blood failed.

(80) PAVONI (G.). **Contributo allo Studio della Infezione Sperimentale del *Mus musculus* con *Leishmania tropica* e *infantum*.** [The Experimental Infection of Mice with *Leishmania tropica* and *Leishmania infantum*.]—*Pathologica.* 1915. March 1. Vol. 7. No. 152. pp. 114–116.

The author records the successful inoculation of mice with *L. tropica* and *L. infantum* by intraperitoneal and intravenous methods, but he has failed with subcutaneous inoculation. Thirty-two positive results were obtained with *L. infantum* and six with *L. tropica*. In a small number of cases lesions developed in connection with the skin after the lapse of some weeks. At first there was merely swelling and oedema of the skin, but a few days later these swellings became ulcerated and necrotic. Parasites could be found in liquid obtained from the oedematous swellings.

In those mice which did not develop skin lesions there was observed after an interval of about three months loss of hair and enlargement of the liver and spleen. The parasites were discoverable in these organs.

The experiments shed some light upon the question of the identity of the parasites responsible for Indian kala azar, infantile kala azar, and oriental boil.

(81) DA SILVA (P.). **Expériences sur la transmission de la leishmaniose infantile par les Puces (*Pulex irritans*).** [Experiments on the Transmission of Infantile Leishmaniasis by Fleas (*Pulex irritans*).] —*Arquiv. Inst. Bact. Camara Pestana.* 1915. Vol. 4. No. 3. pp. 261–267.

In this paper the author records his experiments, in which a number of fleas were made to suck blood from a child that was seriously affected with kala azar. The fleas were fed upon the author for a period of at least a fortnight before being used and their faeces were carefully examined for the presence of any parasites resembling Leishmania. Five of the fleas originally collected were rejected on account of the presence of parasites of this type in their dejecta.

The fleas were fixed to threads in a manner similar to that adopted by NÖLLER, but silk was used in the place of silver wire. They were allowed to suck as long as they wished and were then incubated at 22° C.

All the dejecta passed by the fleas were very carefully examined microscopically after staining with Giemsa, and the fleas were kept alive for periods sufficiently long to allow any cycle of development to take place.

Twenty-five fleas were used, but in no case were Leishmania found in their faeces whether these were passed during the periods when the fleas were placed on the child or during the intervals.

(82) YAKIMOFF (W. L.) & SCHOCKOV (N. F.). **Leishmaniose cutanée (bouton d'Orient), au Turkestan russe.** [Cutaneous Leishmaniasis (Oriental Boil) in Russian Turkestan.]—*C. R. Soc. Biol.* 1915. March 19. Vol. 78. No. 5. pp. 107–109.

The authors find that there are two varieties of *L. tropica* responsible for cutaneous lesions in Turkestan. To these they give the distinguishing names "*major*" and "*minor*."

L. tropica major.—The majority of the parasites are large and spherical. The cytoplasm often contains vacuoles and the nucleus, which is composed of separate granules, stains somewhat faintly. The blepharoplast may be either rod-shaped, circular, or curved, and stains more intensely.

L. tropica minor.—This parasite is generally shaped like a rice grain, but round and oval forms occur. The cytoplasm is compact and stains deeply. In it there can sometimes be seen small black granules resembling those seen in malarial parasites. The nucleus is oval or round, and compact in structure. The blepharoplast is rod-shaped.

The large forms may measure 5·5 microns but the small ones do not exceed 4 microns in their greatest diameter.

The Brazilian form of the parasite has not been observed. A mouse inoculated intraperitoneally with material derived from a lesion contracted generalised leishmaniasis.

Good results have followed the dusting of the lesions with medicinal methylene blue.

A dog was seen which had one lesion on the neck and one on the back. In these parasites measuring 8 microns were found.

SPIROCHAETOSIS.

(83) ZINSSER (H.), HOPKINS (J. G.) & GILBERT (Ruth). **Notes on the Cultivation of *Treponema pallidum*.**—*Jl. Experim. Med.* 1915. Mar. 1. Vol. 21. No. 3. pp. 213–220. With 1 plate.

The authors confine themselves in this paper to a discussion of methods employed after a strain of the organism has once been obtained in vitro, leaving for a future report the subject of obtaining primary cultures from rabbits inoculated intratesticularly from human sources.

The strain used in these experiments was first passed under great pressure through a Berkefeld N. filter which had been used before, and it so happened that the treponema came through without any

bacteria. To test filtration as a method of isolation 44 filtration experiments of duration varying from one minute to two hours were carried out, but in no case were spirochaetes obtained without accompanying bacteria. The authors believe that these experiments prove that an ultramicroscopic form of the spirochaetes does not exist. The first pure cultures were obtained by Noguchi's method, employing heated human ascitic fluid mixed with agar after the addition of fresh rabbit kidney, the medium being covered with sterile paraffin oil. Successes were also obtained in gelatinised horse, ox, or sheep serum with and without the addition of tissue. It was necessary for other investigations to obtain large quantities of culture in a fluid medium, and the most successful method devised was the following:—Fluid serum-agar was poured into 200 cc. flasks to a height of about an inch. Pieces of sterile tissue were introduced and the medium inoculated. When the agar had set it was covered with a mixture of either salt solution and heated ascitic fluid, or slightly acid broth and ascitic fluid, up to the neck of the flask. A few pieces of sterile tissue were floated in the liquid, and a layer of paraffin oil was placed on the top.

Large quantities of growth were obtained in the liquid in from 2 to 4 weeks. Subsequently it was found to be unnecessary to use any agar, and for 6 months the strain has been maintained in serum broth mixtures with sterile rabbit kidney.

A number of experiments induced the authors to use heated tissue in the place of fresh tissue for addition to the medium. This was tried after the tenth culture generation and good growths were obtained. Cultures have been obtained in media composed of slightly acid meat infusion broth with heated sheep serum, together with autoclaved rabbit kidney, liver, spleen, brain, lung, heart, and skeletal muscle. It was also found that the tissue could be replaced by living *Staphylococcus aureus*, *Micrococcus candicans*, or other organisms. Finally the same strain was successfully cultivated in a simple medium composed of meat juice as obtained in the preparation of broth after autoclaving without other additions.

The authors do not think that the organism could have been cultivated in these media immediately after isolation. The ease with which cultures were obtained led them to take steps to make certain that *Treponema pallidum* was in reality the organism cultivated. Inoculation of rabbits before attenuation occurred had unfortunately been omitted, but comparison with three strains obtained from Noguchi confirmed the identity.

The treponemata are obtained by first centrifuging slowly to precipitate the clumps of coagulated protein, and then at high speed to collect the organisms. The yield may be increased by triturating the coagula in a mortar and treating them separately.

Lung tissue and supra-renal tissue appear to have been especially favourable tissues to use.

(84) Wolbach (W. B.). **On the Filterability and Biology of Spirochaetes.**—*Amer. Jl. Trop. Dis. & Prevent Med.* 1915. Feb. Vol 2. No. 8. pp. 494–505. With 2 plates comprising 13 figs.

Spirochaeta duttoni.—In studying this parasite the author has employed the technique of which he published an account in the

Journal of Medical Research in 1914, and by means of which parasites can be stained in sections and their distribution accurately studied. The results obtained confirm those of MARCHOUX and COUVY, who worked with the spirochaete of the fowl in *Argas persicus*, in disproving that the granules found in the epithelial cells come from spirochaetes. The method also proves that spirochaetes migrate through all the tissues and the ova of ticks, and that all the phenomena of transmission can be explained by this fact alone. Coiled and " encysted " forms can be found in the muscular and connective tissues of ticks, but they probably have nothing to do with multiplication.

Since it was shown by TODD and WOLBACH that *S. duttoni* could be forced through a Berkefeld filter by a pressure of over 50 pounds to the square inch, the work in connection with the filterability of spirochaetes was carried on with free living spirochaetes—*S. elusa* and *S. biflexa*. *S. elusa* shows all the morphological characters presented by pathogenic spirochaetes including the coiled and " encysted " forms. All attempts to show that these latter forms had anything to do with reproduction or were even viable failed.

By repeated filtrations in series the author was able to get 100 per cent. of filtrates containing spirochaetes, the effect probably of a process of selection. By suitable technique he was also able to show the presence of spirochaetes in the thickness of the walls of the filter used. While repeated filtration increased the motility of the organism, direct subcultures gradually lost their power of movement.

The non-pathogenic spiral organisms isolated were capable of multiplying in and on artificial media with the production of visible colonies. On the other hand their morphological characters were very like those of the pathogenic spirochaetes and of *Treponema pallidum*.

TOXOPLASMOSIS.

(85) LAVERAN (A.). **Nouvelle contribution à l'étude du** *Toxoplasma gondii*. [**A Further Contribution to the Study of** *Toxoplasma gondii*.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 58–63. With 1 text-fig.

In addition to the animals previously reported as having been proved susceptible to this parasite by experimental inoculation, the following have been successfully infected by the author :—dwarf mice, field mice, jerboa, and European dormice. Failure has followed the inoculation of small dormice (of Southern Europe and North Africa), a musk rat, and pigeon. Details of the various inoculations are given.

Attention is drawn to the fact that while mammals and birds can be successfully infected, closely allied animals such as the rat and the mouse, and the two kinds of dormice may be susceptible and insusceptible respectively. It is also stated that the parasite, which in 1913 was found to be of very low virulence for the pigeon, has completely lost its power of infecting that bird after numerous passages through the mouse.

Regarding the morphology of the parasite the author states that during his earlier observations on the parasite certain appearances were encountered which suggested that multiple division of the nucleus

took place. In preparations stained by the iron haematoxylin method groups of toxoplasms were found apparently enclosed in a cyst. Subsequent examinations showed that in reality these parasites were enclosed in cells the nuclei of which had not taken the stain. The author now expresses the view that in the multiplication of the parasite multiple division of the nucleus of the parasite does not take place.

Numerous preparations have been examined for the presence of a centrosome in the parasite, but none has been discovered. Nor has the author been able to see the least trace of a flagellum either in freshly obtained parasites or in parasites kept in a moist chamber for 48 hours.

A number of attempts to obtain artificial cultures have failed.

PROTOZOA.

(86) Woodcock (H. M.) & Lapage (G.). **Observation on the Life-Cycle of a New Flagellate *Helkesimastix faecicola*, n. g., n. sp.: together with Remarks on the Question of Syngamy in the Trypanosomes.**—*Proc. Roy. Soc.* 1915. Feb. 1. Series B. Vol. 88. No. B 604. pp. 353–370. With 2 plates comprising 60 figs.

The flagellate described in this paper has been found in the faeces of the goat and sheep, and during its passage through the alimentary canal it appears to remain in an encysted condition. The cysts are spherical or ovoid, and measure about 3 microns in diameter. There is a distinct but not very thick wall which appears to be single. The protoplasm is homogeneous or finely granular, and the nucleus and sometimes a karyosome can be made out, but there is no vacuole. No division takes place within the cyst. In artificial cultures the cyst wall may disappear within about 22 hours and the parasite may become somewhat elongated after its disappearance. The wall does not rupture as is shown by the fact that no empty cyst is left behind when the parasite moves away. Excystment has only been observed in preparations in which aerobic bacilli were numerously present. The elongated parasite shows a minute contractile vacuole. Within a few minutes small jerky movements were seen, and a short flagellum projecting from about the middle of the body was observed. The parasite then increased somewhat in size, and the flagellum became longer and moved towards the anterior end of the body. Within about 20 minutes short gliding movements were observed and in an hour the parasite was seen to glide steadily out of the field of vision.

In the meantime the protoplasm had become granular and the nucleus could not be made out.

The active individual is described as being shaped rather like a carrot and measuring 6 to 7 microns in length by 2 to 2·5 in width. The single flagellum is two to three times the length of the body, is always directed backwards, and is dorsal in position. There is no centrosome.

Two types of movement are exhibited. One is seen when the organism glides along the surface of fluid, during which the only movements of the organism itself are slight jerky motions from side

to side made by the anterior end. Possibly surface tension plays some part in the production of this type of movement. When an individual is in the depths of a liquid medium undulating movements of the body and the flagellum are made.

After remaining active for some hours multiplication commences. An individual that is about to divide comes to rest and acquires a rounded shape, the flagellum being apparently lost. At this stage two karysomes can often be seen in the nucleus. In a few minutes the body becomes elongated and then dumb-bell shaped and the nucleus divides, one part going into each end. About this time two new flagella appear, one towards each end and at opposite sides of the body. Ultimately the two parts separate from each other. The whole process takes from 15 to 30 minutes. In cultures multiplication goes on for two or three days, and then conjugation occurs. Actual conjugation has not been observed, but in preparations in which it has been effected the pairs of individuals generally have somewhat characteristic morphology. One is usually longer and not so plump-looking as the other, and the posterior extremity is turned slightly to one side. A foot-note states that it is considered that the tendency to adhere in couples is purely a matter of surface tension. A detailed description is given of the series of changes observed in a pair of these adherent and subsequently united individuals up to the time when by a process of shrinkage it becomes rounded in shape and provided with a cyst wall. Many hours appear to be necessary for the completion of the development. The biology of the parasite is to form the subject of further investigations, but it is said that repeated cultivations of the parasite while in the active condition leads to a loss of power of cyst-formation, the flagellates simply dying off after a time.

In some instances parasites with as many as five flagella and nuclei have been observed, these forms, however, do not become cysts, but divide. It is thought that they do not represent true syngamy, but are due to physical rather than vital factors. The authors think that the observations made on the non-conjugating strain, which they had cultivated through 35 generations during 20 weeks up to the time of writing, warrant the view that the power of cyst-formation and of undergoing true syngamy has been lost by it.

In the authors' view this has some bearing on the question of the absence of syngamy in trypanosomes, surfeit of nutrition and absence of any chemical substance to which flagellates react by conjugation explaining the absence of syngamy in the trypanosomes. The objections which may be raised are: trypanosomes may be inoculated indefinitely without showing conjugation; binucleate flagellates of insects have an alternation of hosts but it appears to be unlikely that syngamy will be observed in them. In the third place in the Haemosporidia, in spite of alternation of host, conjugation occurs.

(87) Stephens (J. W. W.) **On the Peculiar Morphological Appearances of a Malarial Parasite.**—*Ann. Trop. Med. & Parasit.* 1915. Mar. 18. Vol. 9. No. 1. pp. 169–172. With 1 coloured plate.

In this paper the author refers to and figures malarial parasites found in a film of blood taken from a child on the Gold Coast which resembled the parasite described by him as *P. tenue*. The slide in question was

prepared by Le FANU who noted the peculiarities of the organisms present in the blood before the author's description of *P. tenue* was published.

The following points are emphasised. The blood cells show no evidence of stretching or distortion, and the peculiar forms of the parasite occur in all parts of the film. Large, apparently normal, quartan parasites are present and it is possible to trace a transition from the normal ring forms to those in which only particles or strands of chromatin occur without any cytoplasm. Three views as to the nature of the parasite appear to be possible: that they are a new species; that they represent degeneration forms; that they are artificial forms produced outside the body under unknown conditions.

(88) FRANÇA (C.). **Quelques Observations sur le Genre Leucocytozoon.** [Some Observations regarding the Genus Leucocytozoon.]—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4. pp. 229–241.

The nature of the host cells of the Leucocytozoa.

The majority of the leucocytozoa are recognised by their sexual forms, and they can be divided into two groups based upon the appearance presented by the host-cells.

In the first group are the parasites which are oval in shape and are parasitic in cells which show fusiform prolongations. In the second group are the rounded parasites, the cell-hosts of which do not show such prolongations. The views that have been expressed by a number of observers regarding the nature of these host-cells are briefly recapitulated, and the author describes some of his own observations on the question.

He states that he has been able to establish the fact that the two types of leucocytozoa are in reality parasites of the red blood corpuscles, and that they are in fact erythrocytozoa.

With regard to schizogony in the Leucocytozoa the author concludes that, taking into consideration the observations of other investigators, the following facts may be considered as established:

Schizogony occurs in the internal organs and gives rise to a number of merozoites. The schizont does not possess any cyst wall. The processes of schizogony occur simultaneously in all the schizonts, so that in an infected animal in which the parasites are undergoing division all are in the same stage of multiplication. The periodic increase in the number of gametes of *L. caulleryi* in the blood of the host are explained by processes of schizogony.

The third section of the paper deals with the Genus *Leucocytozoon* and its characters.

The author thinks that although the parasites classed as leucocytozoa are in reality haemocytozoa, the name should be retained in spite of its being incorrect.

The adult gametes are of two distinct types morphologically and also in regard to the effect which they produce on the host cells. Structurally however the two types closely resemble each other.

The macrogametocytes of the round or of the oval type possess granular cytoplasm, and their nuclei, which are round, are composed of granules one of which is especially large and may be intra- or extranuclear in position. This granule is analogous in some of its characters to a blepharoplast.

The microgametocytes are also rounded or oval according to the species. They have a smaller amount of cell substance. Their nucleus is somewhat large, oval or irregular in outline, and shows no caryosome.

Ordinarily the parasites contain no pigment.

The microgametes closely resemble the corresponding stage of the plasmodia.

The genus *Leucocytozoon* should be included with the genera *Plasmodium*, *Laverania*, *Haemoproteus*, *Proteosoma*, and *Haemocystidium* in the family *Haemamoebidae* Ross.

(89) Mesnil (F.). **Sur la Position Systématique des Hémosporidies.** [The Position of the Haemosporidia in Schemes of Classification.] —*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4. pp. 241–244.

After discussing certain points raised in França's paper (see above) regarding the classification of these parasites, the author concludes that the Haemosporidia, or better the Haemocytozoa, comprise a number of parasites which have no common characters save those that are common to the Coccidia in general. This method of grouping is not longer permissible. The names Haemocytozoon and Leucocytozoon may be retained to designate parasites occurring in one or other type of blood corpuscle, but it must be understood that these names have no taxonomic value.

(90) Adie (Helen). **The Sporogony of** *Haemoproteus columbae.*— *Indian Jl. Med. Research.* 1915. Jan. Vol, 2. No. 3. pp. 671–680. With 3 plates.

The author's work was carried out in connection with the investigations of Acton and Knowles [see this *Bulletin*, 1914. Vol. 2. p. 180], and the results supplement those of these authors.

The fly used in the experiments was *Lynchia maura* and a few details are given regarding the general characters of this fly.

The fly is a small hippoboscid with a small abdomen and long overlapping wings. The total length of a new born fly is 5·5 mm. and the wings measure 7 mm. The front of the head is characterised by projecting palps, enclosing the haustellum. The flies begin to deposit pupae about a week after they have hatched out, and the mature fly emerges from the pupa case after a period ranging from 31 days upwards depending upon the temperature. The fly will feed upon a pigeon within a few hours of hatching.

The fly cannot be kept without food for more than 48 hours, and there appears to be nothing that can be substituted for blood as food. Both sexes carry the infection.

The alimentary canal of the fly conforms to the general plan seen in bloodsucking flies.

The salivary glands, which are about 1 mm. in length by 0·2 mm. in width, occupy a ventral position in the abdomen. The ducts from these glands, which are lined by large epithelial cells, lead to goblet shaped bodies which are lined with small papillae. Beyond these structures the ducts are thicker walled and coiled, and they subsequently join and lead to the bulb. The parasite, the flagellating parasites, and the

vermicules have been described by other authors and no repetition of their morphological characters is given here.

The zygotes are generally found in the lower part of the mid-gut, not far from the Malpighian tubes. They range in size from 7·2 microns to large bursting cysts measuring 36·5 microns. In these larger parasites bundles of sporozoites can sometimes be seen. The zygotes contain rounded particles of pigment scattered through their substance. The sporozoites have been found in large numbers in the salivary gland-substance and also in the secretion from the glands. The sporozoites are the ordinary sickle-shaped bodies as found in Proteosoma and measure from 7 to 10 microns.

Brief details are given of experiments which showed that new-born flies can acquire the infection from infected pigeons and also that infected flies can transmit the infection to clean pigeons. These experiments also furnished evidence which appeared to contradict ARAGAO'S statement that if infected flies are fed for three days upon clean pigeons they cease to be infective.

(91) GONDER (R.). **Zur Uebertragung von *Haemoproteus columbae*.** [The Transmission of *Haemoproteus columbae*.]—*Arch. f. Protistenk.* 1915. Mar. 1. Vol. 35. No. 3. pp. 316–323.

In this paper the author reiterates the views regarding the transmission of *Haemoproteus columbae* which he expressed at the International Medical Congress in London in 1913.

The conclusions arrived at as a result of his experiments carried out in 1910 in Africa may be summarised as follows :—

The parasite develops in the fly—*Lynchia capensis olfersia*—only as far as the ookinete stage, and flies remain infective so long as ookinetes persist in the stomach.

Flies become " clean " when they have a full meal on an uninfected pigeon, but the flies never become immune and can be reinfected. Flies cannot become " clean " when they feed upon infected pigeons.

The infection cannot be transmitted from pigeon to pigeon experimentally by inoculation with blood, but if the blood is first placed for a time in a moist chamber under conditions causing the production of ookinetes infection can be produced. It can also be produced by inoculating with materials derived from the lungs.

HELMINTHS.

(92) GAIGER (S. H.). **A Revised Check List of the Animal Parasities of Domesticated Animals in India.**—*Jl. Comp. Path. & Therapeutics.* 1915. Mar. Vol. 28. No. 1. pp. 67–76.

" A preliminary check list was published in 1910 in the *Journal of Tropical Veterinary Science*, Vol. 5. No. 1. This list has now been considerably added to, revised, and corrected, and the older names by which parasites used to be known have been replaced by their more recent names."

(93) SEURAT (L.-G.). **Sur l'existence en Algérie, du *Dermatoxys veligera* (Rud.) et sur les affinités du genre *Dermatoxys*.** [The Occurrence of *Dermatoxys veligera* (Rud.) in Algeria and the Relationships of the Genus *Dermatoxys*.—*C. R. Soc. Biol.* 1915. Mar. 19. Vol. 78. No 5. pp. 75–79. With 4 text-figures.

Dermatoxys veligera (Rud.).—The parasite is white in colour and has a cuticle marked with a fine transverse striation. The head is rather wider than the portion of the body immediately behind it. There are two large lateral alae which extend backwards as far as the bulb of the oesophagus. The excretory pore is very small and is situated just posterior to the bulb of the oesophagus. The mouth is margined by three lips each of which carries two papillae and on its inner face a tooth. The bulb of the oesophagus is devoid of any denticular apparatus which is so characteristic of the Oxyures. The oesophagus in the female measures $\frac{1}{9}$ the length of the body and in the male is rather longer. The nerve ring is placed in an anterior position. The male measures about 11 mm. in length and 435 microns at the thickest part. The body is straight or slightly curved at the caudal extremity. In addition to the cephalic alae there are two very long lateral wings on the posterior portion of the body which unite just in front of the extremity of the tail. The tail is regularly conical and the cloaca opens 400 microns in front of the extremity. At a point 700 microns in front of the cloaca there are 10 to 17 parallel cuticular ridges which are placed transversely in a manner resembling a curry comb. Between these ridges and the cloaca there are two rows of small projections.

The pericloacal area is covered with sessile papillae which nearly touch each other. In front of the anus there are six papillae, four of which are situated on the superior lip. The inferior lip shows three papillae of which the middle one is the largest. There are two large post-anal papillae.

The spicule is very small, measuring only 85 microns.

The female is about half as large again as the male. The conical tail is covered with a little sheath of brown chitin. The excretory pore opens 1·3 mm. from the bulb of the oesophagus. The vulva is not prominent and opens just anterior to the middle point of the body. The ovijector and the vagina have remarkably thick muscular walls. In its distal part the ovijector is related to a dark-coloured ovoid glandular structure.

The eggs are slightly flatted on one face and measure 110 by 50 microns. The inner surface of the shell is lined with a very distinct vitelline membrane and at one pole there is an area where the shell is less resistant.

The parasite occurs in the caecum of *Lepus kabilicus*.

(94) RAILLIET (A.) & HENRY (A.). **Sur un Cénure de la Gerbille à pieds velus.** [A Coenurus of the Hairy-footed Gerbil.]—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4. pp. 173–177. With 3 text-figures.

This parasite was found in the abdominal wall of a Tunisian gerbil. It measured 12·5 by 10·5 millimetres and its outer surface was slightly bosselated. On opening the cyst the bosselations were found to be much more prominent on the inner face, and each of them showed a number of secondary prominences on their surface.

Examination revealed that each of these secondary projections contained an invaginated scolex which was provided with a double row of hooks and four rounded suckers. The paper contains a list of the coenuri known up to the present together with a tabulated statement regarding the number and size of the hooklets present in each.

The authors conclude that the cyst described is a new species and suggest the name *Coenurus* or *Multiceps glomeratus*.

(95) Seurat (L.-G.). **Sur deux nouveaux Spiroptères des Carnivores.** [Two New Spiroptera of the Carnivora.]—*C. R. Soc. Biol.* 1915. Apr. 30. Vol. 78. No. 7. pp. 157–161. With 6 text-figs.

1. *Habronema grimaldiae* n. sp.—This parasite has been found in the oesophagus and stomach of the Algerian fox upon two occasions, and, in all, two females and four males have been examined.

The general characters of the species are:—The body is stout in comparison with its length in the posterior two thirds, but the anterior third is attenuated. The thick cuticle is transversely striated, the striations being 12 microns apart. There are two precervical papillae symmetrically placed slightly anterior to the nerve ring. The buccal cavity shows two lateral lips which have three teeth upon them, and a dorsal and a ventral lip the edges of which are hollowed out. The buccal cavity is short, but the oesophagus is long. In the female this amounts to $\frac{3}{8}$ of the total length and in the male to nearly half. The excretory pore opens immediately posterior to the nerve ring.

The female is about 22 millimetres in length and is 780 microns in thickness at the thickest part. The tail is short and conical. The vulva is small and not prominent. It is placed about the middle point of the body. The ovijector is directed backwards, the vestibule has thick muscular walls, and its small lumen contains about six eggs. The uterus is Y-shaped. The epithelial cells lining the unpaired branch appear to be in contact with each other obliterating the lumen, but the paired branches which are a little longer run backwards and contain a number of eggs in linear series.

The ovaries are slender and long. The eggs have thick shells, and contain mature larvae. They measure 52 by 31 microns.

The males measure about 15 millimetres in length and 370 microns at the thickest part. The tail is curved at its extremity. The cloaca which is bordered by rather prominent lips opens 330 microns in front of the posterior extremity. In the precloacal region the ventral aspect of the body shows a number of small longitudinal ridges. The caudal wings measure 1·5 mm. The dorsal aspect of these shows a very loose transverse striation, while the ventral aspect shows longitudinal striations placed much more widely apart.

There are six pairs of pedunculated papillae near the cloaca, three pairs of very small papillae just in front of the extremity of the tail, and a large unpaired papilla on the superior lip of the cloaca.

The spicules are not quite equal in length, and the longer one which is rounded at its extremity is thicker than the finer one which terminates in a point. The longer spicule is about 1·5 mm. in length.

Habronema nouveli n. sp.—Only the female of this worm is known, and of these six specimens have been found in the stomach and intestine of a genet killed near Algiers.

This parasite is white or pinkish in colour and has two lateral wings which begin 80 microns behind the head and extend to a point one millimetre in front of the anus. The cervical papillae are asymmetrically placed, the left being anterior to the right. The excretory pore is very distinct and opens on the ventral surface of the body posterior to the right cervical papilla.

The mouth is bounded by two lateral lips carrying three teeth which project slightly into the buccal cavity. The rim of the buccal cavity shows three pairs of papillae.

The female is about 15 millimetres in length and has a short conical tail which is truncated obliquely, the truncated part showing about a dozen little prominences arranged in a circle. The oesophagus is about "1/5, 7" the length of the body, and the vulva, which is difficult to make out, opens immediately anterior to the middle point of the body. The ovijector exactly resembles that of *Habronema chevreuxi*.

The extremities of the branches of the uterus form S-shaped curves. The oviducts are 800 microns in length and the ovaries 3·5 mm. in length and narrow.

The eggs are elliptical, possess thick shells, and measure 38 by 20 microns.

The male parasite is unknown.

(96) Seurat (L.-G.). **Sur deux nouveaux parasites du Renard d'Algérie.** [Two New Parasites of the Algerian Fox.]—*C. R. Soc. Biol.* 1915. Apr. 2. Vol. 78. No. 6. pp. 122–126. With 4 text-figs.

Spirocerca subaequalis Molin.—A single female of this species was found in a tumour near the pylorus of the stomach of one of two Algerian foxes examined. (For a description of this parasite see this *Bulletin*. Vol. 1. No. 5. Dec. 1913. p. 312. In the original of the paper there abstracted the author referred to the parasite as *Spiroptera subaequalis*.)

The other parasite, *Allodapa numidica* n. sp., was found in the caecum. In one of the foxes there were 88 females and 34 males, and in the second one male and three females were found.

The general characters of this species are as follows :—

The body is straight and slender except for a curving of the tail in the male. The cuticle is thick and very closely striated transversely. There are no cephalic alae. The excretory pore opens on the middle line of the ventral surface not far from the nerve ring.

There are two lateral lips to the mouth, but they are not very well marked. Each carries three papillae. The buccal cavity is divided into two portions. The upper part is bounded by a thick chitinous wall, while the lower portion, which has equally thick walls, has three slightly projecting teeth marking the entrance to the oesophagus.

The oesophagus is slightly swollen in the posterior part and connects by means of a constricted part with a distinct bulb containing the teeth.

The male worm measures from 13·5 to 18 mm. in length and 370 microns at its thickest part.

The tail may show either a slight curve or a complete turn. The cloaca has prominent lips. The caudal alae are very small. On the

ventral surface there is an oval area showing marked transverse striation and surrounded by series of rectangular plates of cuticle. There are four pairs of pre-anal and six pairs of post-anal papillae. The caudal glands open immediately behind the second pair of papillae.

The spicules measure 600 and 440 microns in length. The large one is striated transversely and its free portion is thickened.

The female measures about 25 mm. in length. The excretory pore opens 600 microns from the cephalic extremity. The vulva is prominent and opens immediately in front of the junction of the anterior and middle thirds of the body. It is connected with an ovijector 1 mm. in length. The ovijector has very thick walls and is lined with cuticle continuous with the external cuticle.

Three parts of the sphincter are distinguishable. The first part has a very thick cuticular lining, the middle portion has a number of elongated cells placed transversely between the muscular coat and the lining, and in the third portion the muscular coat gradually diminishes in thickness.

The branches of the uterus are very long and are folded upon themselves a number of times.

There is no distinct seminal vesicle. The ovaries are about 4·5 mm. in length and are placed one immediately in front of and the other immediately behind the vulva.

The eggs have thin envelopes and measure 63 microns in diametre. They are nearly round, and contain mature embryos.

BITING FLIES.

(97) Roubaud (E.). **Sur un essai d'élevage de Glossines dans les laboratoires d'Europe.** [An Attempt to raise Glossinae in the Laboratories of Europe.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 34–36.

This paper contains what appears to be the first record of attempts to raise Glossinae in European Laboratories. The author who returned from Senegal in December 1913 brought with him about a score of pupae belonging to the species *G. palpalis* and *G. morsitans*. The older pupae were killed off by the cold during the winter, but the younger ones survived and a certain number of adults were hatched out in the Pasteur Institute. The flies were kept in incubators at 24–25° C. and were fed daily upon guinea-pigs or rabbits.

Only two specimens of *G. palpalis* were obtained and both of these were males. These flies lived for about five weeks, but the absence of any females made it impossible to raise a fresh generation.

The pupae of *G. morsitans* gave rise to two males and six females. One of these flies formed the starting point of a strain which had at the time of writing been maintained for a year. The conditions under which the flies were kept were: a temperature of 24° to 25° C. and an average humidity of 50–55 per cent. At this temperature a larva was produced every 10 or 11 days, and one of the flies dropped as many as 14.

The duration of life of the flies varied from three weeks to five-and-a-half months, and the period elapsing between the formation of the pupa and hatching was from four to five weeks. The total number of descendants obtained from one of the flies during the course of the year was only twenty, but a number were lost through accidental causes during the months of August and September.

It is said that to raise the flies satisfactorily in incubators there must be some means of ventilating them so as to obtain a change of air, as otherwise the development is poor. In the case of *G. morsitans* a higher percentage of moisture than 60 is to be avoided.

During June some of the flies were exposed to a temperature of 10° to 27° C. for a period of a week and they survived, but the author thinks that Glossinae would never survive in Europe under natural conditions.

RABIES.

(98) Moon (V. H.). **Further Observations on the Effect of Quinin in Rabies.**—*Jl. Infect. Dis.* 1915. Jan. Vol. 16. No. 1. pp. 58–62.

The author gives a summary of seven groups of animals—rabbits and dogs—which were infected experimentally with rabies (street virus) and treated with quinine either by the mouth, or by subcutaneous and intravenous injection.

A brief account is also given of two cases of rabies in the human subject which were subjected to treatment along the same lines. In both of these cases the disease was somewhat far advanced when treatment was resorted to.

The conclusions may be summarised as follows :—

Quinine is not constantly effective either as a cure or as a protective agent in rabies in animals, and when given in the later stages of cases of the disease in man it produces no significant results. It would appear to have the effect of retarding the development of the disease if given in large dose during the period of incubation.

(99) Krumwiede (C.) Jr. & Mann (Alice G.). **The Effect of Quinin on Rabies.**—*Jl. Infect Dis.* 1915. Jan. Vol. 16. No. 1. pp. 24–25.

The experiments recorded in this paper were carried out to check the results published by Moon in 1913. Owing to the results obtained the work was discontinued, but the negative results published by Cummings, and by Frothingham and Halliday, warrant the publication of the authors' results.

A number of rabbits were inoculated intracranially with fixed virus and were subsequently treated with quinine, the treatment being started on different days after the inoculations. Quinine bisulphide was used in a 1 to 8 solution in water and it was administered by injection, but it is not stated by what path the injections were given. Some of the rabbits were killed with quinine.

The quinine did not appear to have the least effect upon the course of the disease.

Six dogs which had been inoculated intracranially with street virus were also subjected to treatment with quinine, but save for one case in which the period of incubation was rather prolonged, although not beyond what is seen in natural cases, and one case in which there was a remission during the course of the disease, all the animals reacted in a normal way and died. The virus obtained from these dogs was pathogenic for guinea-pigs, and typical Negri bodies were found in the brain tissue of each one of the dogs.

MISCELLANEOUS.

(100) Griffiths (J. A.). **Demodectic Mange of Domesticated Animals in Nyasaland.**—*Jl. Comp. Path. & Therapeutics.* 1915. Mar. Vol. 28. No. 1. pp. 61–64. With 1 text-fig.

The disease appears to have been first recognised about five years ago, but it is probable that it was introduced by imported animals some years previously.

Practically all the cases that have been seen have occurred in the Shire Highlands, where the disease has been found in cattle, sheep, pigs, dogs, and cats. It is, however, among cattle that the greatest amount of infection has been found.

The first evidence of infection is the appearance of a crop of nodules on the skin, generally in the neck and shoulders. These gradually spread to the rest of the body, and in neglected cases tend to coalesce and burst, discharging purulent contents. The inflammation resulting causes the skin to become harsh, wrinkled, and denuded of hair.

The disease may persist in the nodular stage without material alteration for periods extending to 18 months or even longer. Affected animals may become very emaciated and in some cases this emaciation may lead to a large percentage of deaths.

Treatment has been limited to prophylactic measures, save for the spraying or dipping of animals that are not sufficiently seriously affected to warrant their slaughter.

In pigs and sheep the nodular condition is not seen, but small pustules make their appearance and subsequently coalesce. There may be very marked emaciation, and many animals die.

In the dog and the cat the disease makes its first appearance on the ears, but subsequently it spreads to the rest of the body.

In those cases in cattle in which the contents of the nodules are purulent rather than cheesy the course of the disease is generally more rapid, and death more commonly occurs.

(101) Pinoy (E.) & Masson (P.). **Mycétome du poumon chez l'âne.** [Mycetoma of the Lung in the Donkey].—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 11–12.

The parasite was discovered in a tumour-like growth in the lung of a donkey, and on examination it appeared to be identical with that described by Grijns as an ascosporous form of *Aspergillus fumigatus*.

(102) KERANDEL (J.). **Insectivore réservoir de virus de la peste au Cambodge.** [An Insectivore as a Reservoir for the Virus of Plague in Cambodia.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 54–57.

A musk rat (*Crocidura murina*), which was found dead in a house where a case of plague had occurred, proved to be infected with an organism which the author identified as the plague bacillus on the grounds of cultural and experimental inoculation results. Examination of musk rats showed that *Laemopsylla cheopis* was more numerous on them than on rats in the same district.

The conclusion drawn is that *Crocidura murina* may act as a reservoir for the virus of plague in exactly the same way as the rat.

(103) NÈGRE (L.) & BOQUET (A.). **Sur la culture du parasite de la lymphangite épizootique.** [The Cultivation of the Parasite of Epizootic Lymphangitis.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 49–52. With 6 text-figs.

In this paper the authors describe some further investigations regarding the cultivation of the cryptococcus. (For previous communication see this *Bulletin*, Vol. 2. No. 3, p. 152.)

The following media have been used:—Coagulated horse or sheep serum to which 6 per cent. of glycerin was added, horse serum agar, ordinary peptone agar, bean agar (gélose au haricot) containing 2 per cent. of glucose and not neutralised. The pus was sown out in the water of condensation of these media to which were added about 20 drops of unneutralised bean broth containing 2 per cent. of either glucose, lactose, or saccharose.

Two forms of development have been observed. On the second or third day some of the cryptococci increase in size and show in their interior a variable number of droplets of oil. These give rise to a number of buds which are divided off from the parent organism by septa. The buds increase in length and become segmented into a series of elements, and from these secondary septate threads are given off. The threads do not as a rule exceed 15 microns in length, but exceptionally they may be as long as 30 microns. Their breadth varies from 2 to 4 microns. There is a distinct double contour and the hyphae show at intervals swellings which may measure 10 microns in diameter. The organisms are difficult to stain.

The mycelial forms described by TOKISHGE and MARCONE make their appearance in a week to a fortnight. Since intact cryptococci and large forms containing droplets of oil may be present at the same time, it is probable that the filaments present in cultures of the second and third generation are not derived from the previous mycelial forms but by a delayed vegetation of cryptococci.

In other cryptococci it was observed that 48 hours after inoculation they had become enlarged and rather rounded in shape, and that the double contoured envelope had an irregular outline. The protoplasm was slightly granular, but did not contain any droplets of oil. Parasites of this type measured from 4 to 6 microns in diameter. Some of them showed a delicate septum across the centre.

These forms were always adherent to the surface of the medium while the mycelial forms were always free in the liquid. The rounded forms resisted all efforts to stain them.

The optimum temperature for growth is between 20° and 30° C. The best media were coagulated horse and sheep serum to which glycerin had been added.

(104) Terry (B. T.). **Different Amounts of Transformed Atoxyl produced by incubating one per cent. and ten per cent. Atoxyl in Blood.**—*Jl. Experim. Med.* 1915. Mar. Vol. 21. No. 3. pp. 258–266.

The Summary of this paper is as follows :—

"1. Ten per cent. atoxyl in blood incubated at 37° C. for 1 hour gives rise to a solution that is much more than ten times as toxic as a 1 per cent. solution of atoxyl similarly incubated.

"2. When the comparison is made after incubation for 3 hours instead of for 1 hour, the toxicity of the 10 per cent. solution is but slightly greater than ten times that of the 1 per cent., provided the red blood corpuscles are not removed from the dilutions.

"3. If the corpuscles are removed from both the 10 per cent. and the 1 per cent. atoxyl solutions immediately after incubation at 37° for 1 to 3 hours, the dilutions of the 10 per cent. atoxyl are much more than ten times as toxic as the corresponding dilutions of the 1 per cent. atoxyl.

"4. After incubation with atoxyl at 37° for 1 to 3 hours, red blood corpuscles left at room temperature in dilutions made from the 10 per cent. and 1 per cent. solutions in blood increase markedly the toxicity of the dilutions made from the 1 per cent. atoxyl, but increase very slightly the toxicity of the dilutions made from the 10 per cent. atoxyl.

"5. If one desires to produce a large amount of transformed atoxyl by incubating atoxyl in blood at 37° for 1 to 3 hours, strong solutions of atoxyl should be chosen in preference to weaker solutions."

(105) Terry (B. T.). **The Effect of Heat on the Transforming and Binding Power of Blood.**—*Jl. Experim. Med.* 1915. Mar. Vol. 21. No. 3. pp. 267–279.

Summary :—

"1. The transforming power of red blood cells for atoxyl is apparently uninfluenced by a preliminary heating of the blood for 30 minutes at 50° C., but a temperature of 55° C. acting for 30 minutes destroys this property of blood almost completely.

"2. When the heating was for 60 minutes, 54° C. and higher temperatures apparently destroyed all the transforming power.

"3. After heating for 10 minutes, 70° C. destroyed almost all the transforming power, and 100° C. seemingly destroyed all.

"4. Under the influence of certain temperatures blood seemingly binds transformed atoxyl, and under the influence of other temperatures frees it again. A temperature of 70° C. for 10 minutes applied to blood subsequent to its incubation with atoxyl causes nearly all the toxicity of the solution to disappear. On the other hand, a temperature of 100° C. for 10 minutes applied to blood subsequent to incubation with atoxyl leaves the solution almost as toxic as if the blood had not been heated at all after the incubation.

"5. Some of the transformed atoxyl bound by blood when it is heated to 70° C. for 10 minutes is freed if the heating at 70° C. is prolonged to 30 minutes.

"6. Blood which has bound transformed atoxyl gives up most, but not all, of this toxic substance when heated to 100° for 10 minutes. All, or nearly all, is freed when the heating at 100° C. is continued for 30 minutes.

"7. Under the influence of 70° C. for 10 minutes transformed atoxyl may be made to enter blood corpuscles, for the fluid above these corpuscles is rendered non-toxic and does not become toxic again when heated to 100° for 20 minutes, provided it contains no laked blood. The blood corpuscles, on the other hand, when heated to 100° for 20 minutes, in contact with fresh salt solution, make this solution quite toxic.

"8. Laked blood in contact with transformed atoxyl behaves like unlaked blood when heated to 70° C. and to 100° C. for 10 to 30 minutes.

"9. The toxic substance can be concentrated by heating the blood corpuscles in contact with transformed atoxyl to 70° C. for 10 minutes, centrifugalizing, removing a large part of the supernatant fluid, and then heating to 100° C. for 30 minutes.

"10. The power of blood to take up and bind transformed atoxyl is destroyed apparently completely by heating blood to 100° C. for 10 minutes.

"11. The toxic substance into which atoxyl is transformed (transformed atoxyl) is thermostabile, but the transforming agent in blood is thermolabile."

(106) Henry (M.). **Mortality among Cattle in the Bega District of New South Wales.**—*Vet. Jl.* 1915. Feb. Vol. 71. No. 476. pp. 62–72.

In this paper the author describes a peculiar disease among cattle which has occurred during February and March each year since 1912. The majority of the animals affected were cows in full milk, and it was only in those areas in which the country was very poor that cases occurred in animals other than milking cows. It also appeared that the disease caused greater losses on farms where attempts had been made to improve the milking capacity of the animals by the importation of Jersey bulls and by other means.

Generally speaking the area affected has steadily increased, but it was noted that in areas where recurrence of the disease did not occur the food supply, which was in general limited to grazing on land greatly infested with rabbits, had been improved. In every case the disease disappeared with the onset of rain. On all the affected farms depraved appetite was common among the cattle, they would chew bones, stocks, dead rabbits, and would eat indigestible and astringent plants.

The affected animals rapidly lost condition and lactation ceased somewhat suddenly. There was evidence of dull abdominal pain, the animals moved stiffly, and in the later stages lay on their sides. The tongue was protruded, salivation was free, and the muscles of mastication and deglutition were paralysed. Death occurred in from 12 hours to a fortnight after symptoms had been observed. Recovery was not common.

The post-mortem appearances were very indefinite and inconstant.

Infection as a causal factor in the production of the disease appears to be excluded. Mortality ceases when cattle are moved from affected to non-affected areas, and animals with which they are mixed do not contract the disease. A fall of rain and improvement in the feeding bring the disease to an end. No known poisonous plant could be detected on affected areas, nor could any fungus on the grass be implicated.

It was particularly noted that the disease occurred where bone chewing and osteomalacia had been previously observed.

Chemical analysis of soils and grasses appeared to indicate a definite connection between poverty of the soil and of the food, and also between poverty of the food and the mortality.

The author inclines to the view that the disease is a deficiency disease, and reference is made to STEAD's statement in connection with lamzieke to the effect that milk contains a substance which possesses protective properties, and draws attention to the fact that in one instance mortality which was very high in a herd of cows suckling their calves rapidly ceased when the calves were weaned.

(107) GRAYBILL (H. W.). **Repellents for protecting Animals from the Attacks of Flies.**—*U. S. Dept. of Agric. Bulletin No. 131.* 1914. 26 pp.

The following is an abstract of the general summary of the matter contained in this *Bulletin* :—

In the United States the principal flies which cause annoyance to cattle are *Stomoxys calcitrans* and *Lyperosia irritans*, and there are certain other flies which, although they do not bite, cause a considerable amount of unrest among animals.

It is thought that the losses generally attributed to the biting flies are exaggerated to some extent.

One author records that flies object to a blue colour, and that they can be banished from cattle sheds by colouring the walls with a blue-coloured wash. It does not appear that this observation has been corroborated. It has been noted by a number of observers that dark coloured animals are more troubled by flies than light coloured ones.

Internal medicaments appear to be of no value as repellents.

Liquids may be applied to the skins of animals by dipping, spraying, or by painting, the method adopted depending upon the nature and the cost of the material used.

Powdered drugs such as pyrethrum are of very little value.

Fish oil is said to be very effective, and it may be used in conjunction with such materials as oil of tar, crude carbolic acid, and kerosene. Such mixtures may be effective for as long as a week. They should be applied lightly with a brush, but they are not safe when used liberally with a spray pump. Pure laurel oil is effective but irritant. Ten per cent. laurel oil in cotton seed oil was found by the author to be ineffective.

Various mixtures of carbolic acid and pine tar in cotton seed oil were found to exercise a repellent action, but they were not effective for more than a day. Oil of tar in cotton seed oil and in Beaumont oil is effective, but such mixtures are not safe to apply liberally if there is 50 per cent. of oil of tar present. The mixtures containing 10 per cent. of oil of tar must be applied every day.

A heavy application of fish oil causes the hair to become sticky and fall out, but a light application does not produce these results.

(108) GRAYBILL (H. W.). **The Action of Arsenical Dips in preventing Tick Infestation.**—*Jl. of Parasitology.* 1914. Sept. Vol. 1. No. 1. pp. 48–49.

A previous paper by the author on this subject was published by the Bureau of Animal Industry in 1913 [see this *Bulletin*, Vol. 1, No. 5, Dec. 1913, p. 318], and the results obtained in the experiments

recorded in that paper showed that cattle dipped in an arsenical dip are protected from becoming infested with ticks for two days, but not for five.

The experiments referred to in the present communication were carried out with the object of ascertaining whether such dipping confers any protection for three or four days, and whether any mortality occurs among ticks placed upon or maturing upon immune animals that have been dipped on a number of occasions at intervals of one or two weeks.

The dip used contained 8 pounds of white arsenic to 500 gallons, but no pine tar was mixed with it.

In the first experiments non-immune calves had placed upon them seed ticks at intervals of three and four days after dipping, other similar calves being left as controls. It was found that while the animals were not absolutely protected from the ticks the infestation in the dipped animals was lighter than in the controls, and, in view of the fact that no dead nymphs were found, it would appear that the lighter infestation was due to an action of the dip upon the larvae.

The second experiment was primarily intended to show whether ticks that have matured on animals that have been regularly dipped show any mortality after dropping off.

Immune calves were divided into three groups. One group was dipped four times at intervals of two weeks, a second group was dipped four times at intervals of one week, and the third batch were left as controls. The ticks were applied five days after the last dipping. The results showed that the dipping does not prevent infestation entirely, but that it reduces it to some extent when the animals are dipped at intervals of a week. The ticks collected showed no abnormality in connection with oviposition and the number of eggs hatching, and the mortality was normal.

(109) Chapin (R. M.). **Arsenical Cattle Dips: Methods of Preparation and Directions for Use.**—*U.S. Dept. Agric. Farmers' Bulletin 603.* 1914. Aug. 14. 16 pp.

This bulletin contains a brief but general summary regarding the preparation and management of arsenical dipping solutions, and is written for the use of the farmer.

The following subjects are dealt with: substances used for making dips and their properties, including antidotes to be used in cases of poisoning; the general composition of dips and the methods of preparing. Diluting the dip, replenishing the bath, correcting the strength, calculating the capacity of a vat, and the safe disposal of waste arsenical baths are also dealt with.

(110) Kolmer (J. A.). **A Method of transmitting Blood Parasites.**—*Jl. Infect. Dis.* 1915. Mar. Vol. 16. No. 2. pp. 311–312.

This short paper contains a description of a method by which blood can be drawn from the heart of living rats without causing any disturbance of health. The skin over the heart is sterilised with tincture of iodine and a sharp syringe needle of suitable size is used to puncture the heart, the blood being withdrawn into a syringe containing citrate solution. In this way practically all chance of contamination is avoided.

(111) Boquet (A.). **Sur les Principales Affections Contagieuses des Animaux de l'Afrique du Nord.** [The Principal Contagious Diseases of Animals occurring in Northern Africa.]—*Bull. & Mém. de la Soc. des Sci. Vet. de Lyon.* 1914. July 2. 30 pp. With 8 figs.

Solipeds:—

Epizootic Lymphangitis.—The author summarises our knowledge regarding this disease and confirms its occurrence in Algeria, Morocco, and Tunis.

Dourine.—This disease has a wide distribution in Algeria. It is most frequently the chronic form which comes under observation. The usual three stages of oedema, plaques, and progressive paralysis are observed. The period of incubation is generally two to three weeks. During the third stage superficial abscesses and conjunctivitis and ulcerative keratitis are seen. Fractures of the limbs are common. In the acute form of the disease the symptoms develop rapidly and death may take place a few days after the onset of locomotor disturbance. Exceptionally horses recover spontaneously, but in the donkey recovery is far more frequent.

The author gives a text-figure of a trypanosome dividing into four daughter trypanosomes.

Taher—Mal de la Zousfana—Debab.—This disease has also a wide distribution. It is characterised by loss of appetite, weakness, and short attacks of high fever. There is progressive paralysis, and at times haematuria is observed. Death generally takes place in from 4 to 6 months. The causal trypanosome is present in the blood in large numbers, and is identical with that causing debab in dromedaries. The latter animals form the reservoir of the virus, and the infection is transmitted from them to horses through the medium of biting flies.

Piroplasmosis.—Acute, sub-acute and chronic cases of this disease are encountered. The causal parasite is *P. equi* and the disease is transmitted by Ixodes. Intramuscular injections of biniodide of mercury and trypanblue (4 to 6 g. in 1 per cent. solution in water) have yielded good results in the treatment of the condition.

Cattle:—

Piroplasmosis.—It would appear that more than one kind of piroplasmosis occurs among cattle in Algeria, as the author refers to the occurrence of parasites closely resembling *P. bigeminum* and also to organisms that are rod-shaped. It is also said that in some animals 60 to 80 per cent. of the blood corpuscles may be invaded without the animals showing any symptoms. Anaplasma also occurs in Algeria.

Black Quarter.—This disease is stated to be one of the most serious occurring in Algeria, but good results have followed the application of different methods of vaccination. Especially good results have been obtained with the method of Leclainche and Vallée.

Sheep Pox.—This disease appears to be less severe during the summer than during the autumn and winter. The mortality ranges on an average from 6 to 10 per cent., but occasionally may be as high as 30 per cent. In young lambs more than 50 per cent. sometimes die. The disease causes great loss of condition and the period of convalescence is very prolonged. Pregnant animals frequently abort, and the secretion of milk is to a great extent suppressed.

Owing to the risks attaching to the importation of sheep from Algeria into other countries a method of vaccinating has been devised. The vaccine consists of a sensitised virus prepared by mixing material containing the virus with anti-pox serum prepared in the manner devised by BORREL, and incubating the mixture for 3 to 5 days at 18–20° C. The mixture is then centrifuged and the sediment added to salt solution in the proportion of 0·005 g. to 0·1 g. per cubic centimetre. This material is injected deeply into the skin behind the shoulder and produces on the fifth or sixth day an area of oedema varying in size up to the palm of the hand. In two or three days this decreases and a little nodule about the size of a nut is left. The method causes no disturbance of health and immunity is complete by the third day and lasts for a year.

The disease occurs in a more serious form in Morocco than in Algeria.

El R'och.—This is a disease of the sheep which is characterised by symptoms of anaemia and progressive cachexia. In the author's view a bacillus of the Preisz-Nocard type, which he has been able to isolate in pure culture from the heart blood, is possibly the cause of the condition.

Bou Frida of Goats.—This name is used to designate a disease of the goat which takes the form of an epizootic pleuro-pneumonia, but it is probable that more than one condition is included under the term. The mortality may reach 60 per cent.

El Debab of Dromedaries.—This disease is caused by a trypanosome *T. berberum*—discovered by the brothers SERGENT in 1904. It is encountered throughout the whole of the northern countries of Africa. According to the describers two species of fly are concerned in the transmission of the trypanosome—*Atylototus tomentotus* and *Atylototus nemoralis*, which are active principally during the month of June.

The disease is frequently responsible for abortion in the female.

Leishmaniasis of the dog.—This disease has been detected in 2·5 per cent. of the dogs killed at the public slaughter-houses, and the author states that infantile kala azar has been found in every place where the condition has been detected in the dog. The course of the disease varies from a few weeks to 15 or 16 months. Transmission is effected through the medium of fleas.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 3, No. 1, pp. 39–40.]

Leishmaniasis.

(112) Lignos (A.). Quelques nouveaux cas de guérison de Kala-Azar infantile observés à Hydra. [Some Fresh Cases of Recovery from Infantile Kala-Azar on the Island of Hydra.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1, pp. 25–28.

Rabies.

(113) Phisalix (Mme. M.). Mécanisme de la résistance des Batraciens et des Serpents au virus rabique. [The Mechanism of the Resistance offered by Batracians and Serpents to the Virus of Rabies.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1, pp. 13–16.

Tick Paralysis.

(114) Strickland (C.). Note on a Case of "Tick-Paralysis" in Australia.—*Parasitology.* 1915. Mar. Vol. 7. No. 4, p. 379.

Trypanosomiasis.

(115) Aubert (P.). Essais de traitement de la trypanosomiase humaine par les dérivés du Diaminoarsénobenzene O_1 et OK_1. [Attempts to treat Human Trypanosomiasis with the Derivatives of Diaminoarsenobenzene O_1 and OK_1.]—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4, pp. 169–172.

Undulant Fever.

(116) Bulletin de l'Office International d'Hygiene Publique. 1915. Feb. Vol. 7. No. 2, pp. 255–299, & Mar. No. 3, pp. 485–501.—Fievre Ondulante. [Undulant Fever.] i. by Jorge (Ricardo), ii. by Sergent (Edm.) & Negre (L.), iii. by de Cottes (J. Duran), iv. by Santoliquido, v. by Nicolle (Ch.).

Biting Flies and Ticks.

(117) Carter (H. F.). On Some previously Undescribed Tabanidae from Africa.—*Ann. Trop. Med. & Parasit.* 1915. Mar. 18. Vol. 9. No. 1, pp. 173–196. With 9 text-figs. & 1 plate comprising 6 figs.

(118) Cragg (F. W.). A Preliminary Note on Fertilization in Cimex.—*Indian Jl. Med. Research.* 1915. Jan. Vol. 2. No. 3, pp. 698–705. With 1 plate comprising 2 figs.

(119) Cragg (F. W.). The Alimentary Tract of Cimex.—*Indian Jl. Med. Research.* 1915. Jan. Vol. 2. No. 3, pp. 706–720. With 2 plates & 2 text figs.

(120) Cunha (R. de A.). Contribuição para o conhecimento dos sifonapteros brazileiros. [The Brazilian Siphonaptera.]—*Mem. Inst. Oswaldo Cruz.* 1914. Vol. 6. No. 2, pp. 124–136. With 2 plates & 3 text-figs.

(121) Hadwen (S.). Warble Flies. A Further Contribution on the Biology of *Hypoderma lineatum* and *Hypoderma bovis*.—*Parasitology.* 1915. Mar. Vol. 7. No. 4, pp. 331–338.

(122) Harrison (L.). On a New Family and Five New Genera of Mallophaga.—*Parasitology.* 1915. Mar. Vol. 7. No. 4, pp. 383–407. With 2 plates & 3 text-figs.

(123) Lutz (A.) & Neiva (A.). As "Tabanidae" do Estado do Rio de Janeiro. [The Tabanidae occurring in the State of Rio de Janeiro.]—*Mem. Inst. Oswaldo Cruz.* 1914. Vol. 6. No. 2, pp. 69–80.

(124) NUTTALL (G. H. F.). Observations on the Biology of Ixodidae. Part II.—*Parasitology.* 1915. Mar. Vol. 7. No. 4, pp. 408–456.

(125) ROUBAUD (E.). Les muscides à larves piqueuses et suceuses de sang. [Biting and Blood-sucking larvae of Muscidae.]—*C. R. Soc. Biol.* 1915. Mar. 19. Vol. 78. No. 5, pp. 92–97. With 2 figs.

(126) SCHWETZ (J.). Preliminary Notes on the Mosquitoes of Kabinda (Lomame), Belgian Congo.—*Ann. Trop. Med. & Parasit.* 1915. Mar. 18. Vol. 9. No. 1, pp. 163–168.

(127) SEN (S. K.). Observations on Respiration of Culicidae.—*Indian Jl. Med. Research.* 1915. Jan. Vol. 2. No. 3, pp. 681–697. With 4 charts and 3 text-figs.

Helminths.

(128) TRAVASSOS (L.). Contribuição para o conhecimento da fauna helmintolojica brazileira. III. Novo genero da familia Heterakidae Railliet & Henry. [Contribution to the Study of Brazilian Helminthology. III. A New Genus of the Family Heterakidae Railliet & Henry.]—*Mem. Inst. Oswaldo Cruz.* 1914. Vol. 6. No. 2, pp. 139–142. With 1 plate comprising 3 figs.

(129) WARD (H. B.) & HIRSCH (E. F.). The Species of Paragonimus and their Differentiation.—*Ann. Trop. Med. & Parasit.* 1915. Mar. 18. Vol. 9. No. 1, pp. 109–162. With 5 plates comprising 23 figs.

(130) YAKIMOW (W. L.), SCHOCHOS (N. I.), KOSELKIN (P. M.), WINOGRADOW (W. W.) & DEMIDOW (A. P.). Die Mikrofilariose der Pferde im Turkestan Gebiete. [Equine microfilariosis in Turkestan.]—*Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust.* 1915. Jan. 13. Vol. 16. No. 4, pp. 275–286.

Protozoa.

(131) KUEHN (A.). Ueber Bau und Encystierung von *Bodo edax* Klebs. [The Structure and Encystment of Bodo edax Klebs.]—*Archiv. f. Protistenk.* 1915. Mar. 1. Vol. 35. No. 3, pp. 212–255. With 1 plate comprising 58 figs.

(132) LÉGER (L.) & DUBOSCQ (O.). Etude sur *Spirocystis nidula* Lég. et Dub. Schizogrégarine du *Lumbriculus variegatus* Müll. [*Spirocystis nidula* Lég. & Dub. Schizogregarine of *Lumbriculus variegatus* Müll.]—*Archiv. f. Protistenk.* 1915. Mar. 1. Vol. 35. No. 3, pp. 199–211. With 1 plate comprising 19 figs. & 4 text-figs.

(133) MOROFF (T.). Zur Kentniss der Sarkosporidien. [Contribution to our Knowledge regarding the Sarcosporidia.]—*Arch. f. Protistenk.* 1915. Mar. 1. Vol. 35. No. 3, pp. 256–315. With 4 plates & 2 text-figs.

Miscellaneous.

(134) BROWN (H. C.) & KIRWAN (E. W. O'G.). Standardisation of Bacterial Suspensions by Opacity.—*Indian Jl. Med. Research.* 1915. Jan. Vol. 2. No. 3, pp. 763–769.